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ABSTRACT

This yearbook contains a report from the president of the Australian Society of Educational Technology and five articles: Theory and Practice in Educational Technology; The Use of Learning Theory in Teaching; Designing Visual Messages; Educational Technology--A Bibliography of Reference Material; and Planning and Evaluating the Use of Audio-Visual Equipment in Schools. (DAG)

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YEAR BOOK

1976

AUSTRALIAN
SOCIETY OF
EDUCATIONAL
TECHNOLOGY

YEARBOOK
1976

Edited by Robert A. Cannon

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AUSTRALIAN
SOCIETY OF
EDUCATIONAL
TECHNOLOGY

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PRESIDENT'S REPORT

Deane W. Hutton

What can be said about a subject which claims to integrate learning theory, perception, educational psychology, communication theory, management studies and educational evaluation? Maybe it has an inflated idea of its own importance - or perhaps it has a new and important point of view to present within the study of education. I speak, of course, of educational technology, which has rapidly gained international stature in the past decade, and drawn a large number of adherents in Australia in the past five years.

The definition of our field adopted by the Australian Society of Educational Technology reflects the wide-ranging and integrating nature of this discipline. We see educational technology as:

the design, application, evaluation and development of systems, methods and materials to improve the process of human learning.

It is significant that our definition points to human beings rather than machinery and equipment, and this centre of attention has been reflected in the activities of the Society in its first year of existence. Our major aims have been to provide for a fellowship of persons interested in educational technology and to provide a forum for examining and exchanging ideas.

The Society has more than 50 members, drawn from primary, secondary, technical and tertiary education, from educational

administration and from service positions. In 1975 we conducted seven general meetings. At most of these meetings, we had a major address and several supporting speakers. The major topics covered were microteaching, the evaluation of audio-visual equipment, educational technology and group size, educational technology in the primary school, educational technology and science teaching, and educational technology in the secondary school. Attendance at these meetings ranged from 25 to 70; and each meeting included an opportunity for questions and suggestions from members.

An important development in our first year of operation has been the search for links with other groups which have similar or related aims to ours. We have established contact with:

- Association of Educational Communication & Technology (U.S.A.)
- Association of Programmed Learning & Educational Technology (U.K.)
- Higher Education Research & Development Society of Australasia
- Modern Teaching Methods Association
- Educational Resources Association (N.S.W.)
- Educational Technology Association (Vic.)
- Media Association (W.A.)
- Society for Mass Media & Resource Technology (S.A.)
- Royal Australian Chemical Institute (Education Branch)
- Australian Librarians Association.

One of our general meetings was a joint venture with the Royal Australian Chemical Institute. Members of both organisations felt that the liaison was mutually beneficial, so the Society has planned further co-operative ventures with other bodies in 1976.

The Society has celebrated its first birthday. Although it was born at the Inaugural Meeting on April 3, 1975, a dedicated Steering Committee had been working steadily on pre-natal care during the long gestation period of more than 12 months. The infant seems to be healthy and adventurous, and the Council is confident that the Society will have a long and useful life.

THEORY AND PRACTICE IN EDUCATIONAL TECHNOLOGY

Edward E. Nunan

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As teachers we have all been aware of, and indeed experienced, the difficulties associated with reconciling theoretical knowledge with the actual practices carried out in the classroom. Indeed, at times when we have reached for theoretical knowledge to assist our efforts we have felt a sense of stasis or paralysis induced by the aimlessness and lack of guidelines for action. On the other hand, we have often been inspired by observing some practitioner 'perform', sensing the 'correctness' of application of techniques in this situation.

This relation of theoretical knowledge to practice is central to the study of educational technology. Perhaps more than in any other educational discipline we are here faced with the problems of *application and practice* brought about by new devices and techniques. It is in this sense that educational technology is concerned with the design, application, evaluation and development of systems, methods and materials in learning. For example, the technology to quickly reproduce the still visual image (photographic methods for slides or overhead-projection) and also the differing forms of retrieval, brings questions as to how we design, apply, evaluate and develop this facility in the classroom. Thus we are immediately led into theories relating to the learner and media properties and are further involved with practical application, design and evaluation.

Consequently, practising teachers through their application (and evaluation) of technological devices and their associated methodological techniques rightly claim to possess a knowledge of educational technology. Like-wise, theoreticians (with interest in contributing disciplines such as psychology, communications and education) assert that their principles which are derived and distilled from practical knowledge are essential to an understanding of educational technology.

Such practising teachers who are involved in implementing media approaches in the classroom have often had to confront problems of theory and practice. If criticised by theoreticians such teachers rightly assert the priority of practice - as they point out, where knowledge is strongly related to practice, the successful pursuit of activities does not necessarily follow from any recall of theoretical principles. A theoretical knowledge of principles may be devoid of any knowledge of application.

They further point out that any achievement of successful practice may be helped by the *integration* of any explicit theoretical principles which might be called to mind. The practitioner then is akin to a medical specialist whose practice is centred upon judgemental decisions about how the integration of his theoretical knowledge is to be applied in a particular case. Thus, true knowledge exists only in the practice or the active involvement of translating any theoretical principles into action.

The theoretician on the other hand, points out that activity (rational, in his terms) can only result from a theoretical knowledge of principles derived from what is known about psychological properties of the learner, perception research, classifications and research into media characteristics and such studies. What is fundamental to the theoretician is that a *derivative* relationship

should exist between theory and practice; theories bring together all of the practice and form a descriptive, explanatory and predictive base from which one can guide, interpret and develop innovative practice.

We can outline two fundamental positions concerning educational technology. The practitioner (and especially the teacher) points to his application and practice of the art, while the theoretician points to the importance of his theoretical constructs in imagery, message design, visual information processing and systems approach.

Traditionally, practitioners and theoreticians have been placed in opposing camps. Practitioners represent 'reality', those who can actually 'do', those who are willing and able to struggle with the immensely more difficult problem of actual application; theoreticians are seen to be spinning fragile (and useless) spider-webs of theoretical interest devoid of reality and practical application. The retreat from the central issues of practice marks the theoretician in the eyes of the practitioner.

Significantly, both groups have fostered "boundaries". The practitioner begins to dismiss theoretical understanding as jargonistic, while theoreticians liken the busy practitioner or teacher to a monkey randomly pressing typewriter keys - activity and intent do not make up for a lack of knowledge.

Such sniping avoids any true understanding of educational technology. The problems posed by these two positions have been considered in Michael Polanyi's works, and because of the special relevance to this situation, it seems necessary to briefly review Polanyi's main ideas. (Polanyi, 1969.)

Polanyi's interest in the area of 'knowing' stems from the well known fact that the aim of a skilful performance is achieved by the observance of a set of rules which are *not known as such* to the person following them. Examples of such performances range from riding a bicycle, woolclassing, ballet dancing, being a scientist, to acupuncture and television production. This does not mean that rules cannot be explicitly stated and written down, but that even where they can be made explicit, their *integration into practice* remains tacit. Thus one can be given explicit procedures for driving a car in a motor manual, baking a cake in a cook book or carrying out sexual intercourse in a sex manual yet not achieve the integration into practice which is necessary to allow one to say that one is a good driver, cook or lover.

The explicit knowledge provided by maxims, rules and theories serve as a guide only if they can be integrated into the practical knowledge of the art. It is this act of integration that Polanyi links with the possession of tacit knowledge. To ask the question of which knowledge is more important or more fundamental is, in part, to miss the point - both forms of knowing are generally used. However, Polanyi believes that we must eventually side with practitioners as he claims that while tacit knowledge may be possessed by itself, explicit knowledge must rely on being tacitly understood. Thus, all knowledge is either tacit or rooted in tacit knowledge.

In the field of educational technology we might ascribe the explicit knowledge position to professional academics who undertake studies in behaviourism, message design, systems and the like - such explicit knowledge is drawn from bastardizing psychological and educational theory, concepts from the social sciences and communication studies, from engineering, and from computer science. Explicit knowledge in educational technology

tends to be diffuse, lacking in structure and often devoid of directives for practical application.

The implicit knowledge position might be strongly seen in producers of instructional materials - here I have in mind professional production experts whose apprenticeship to a master film or television producer allows a special practical expertise in this area. Clearly, such people have a craft - knowledge of the art of educational technology; procedures are not prescriptively laid down by rules but more in the adaptations of exemplars of the master film or television producer.

The classroom teacher (whether at the junior primary, primary, secondary, or tertiary level) is in a special position often stretched between these two 'extremes'. On the one hand he finds the need to call for some 'theoretical' knowledge to help initiate practice, yet, on the other his own practice in the classroom contains many tacit components which are essential to applying what might be seen as 'over-theorised' explicit knowledge.

The teacher is in the unique position of being at the battlefront of developing technologies of education. Further, it must be realised that practice and theory must be interactive if any vital educational technology is to develop. One must follow intuitively tacit components as well as listening to what is explicit. Interaction, not opposition of tacit and explicit knowledge holds the key to effective educational technology.

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THE USE OF LEARNING THEORY IN TEACHING

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Introduction

Getzels' (1952) advice that in psychology or education, selection and restriction of content must be made, and that this can best be done in terms of some unifying conceptual scheme or focus, has certainly been followed in this short article. Selections of learning theories classified under three headings (types of learning, hierarchical theories of development and programmed learning) are briefly outlined, critically commented upon, and practical examples of their applications given. It is hoped that the article will encourage teachers at all levels of education to construct frameworks for curriculum planning, educational decision-making and effective teaching. For further reading, Snelbecker (1974) is strongly recommended, together with references cited.

Types of learning

Kendler (1964) in his summary of concept learning came to the conclusion that "It is easy to get depressed about the current status of our knowledge of conceptual behaviour. We know so little. We have so much to learn. Yet depression, or even disappointment, is not justified. Different empirical techniques have been developed, knowledge is being gathered, and some integrating ideas, even if they are limited in scope, are being offered". The field of problem solving is even more depressing! There is reasonable agreement about the definitions of "concept" (although there is wide disagreement on how a concept is learnt); there is no such agreement about "problem solving".

Concept learning

Four definitions of a concept seem to cover the research field:

- (a) vehicles of thought (c.f. Piaget)
- (b) the meaning of words (c.f. Ausubel)
- (c) the label of a set of things with something in common (c.f. Vygotsky)
- (d) a series of stimuli leading to the same response (c.f. Gagné).

Mathews (1970) has been particularly scathing in his attack of concept "learning": "Children don't learn concepts, they acquire them. A concept is formed when the penny finally drops."

Mathews' position is untenable. He is merely substituting one jargon word for another and to suggest that concepts cannot be learnt is to ignore a mass of experimental evidence. His real complaint is against the ways concept are taught. In the Primary School these experiences need to be "hand-on"; at the tertiary level second-hand experience (provided by lecture notes or text books) is often sufficient. A mixture of the two is possible at the secondary level.

Concepts are powerful tools. Bruner (1956) has suggested that there are five reasons for "categorising" (i.e. forming concepts):

1. to reduce complexity,
2. to enable objects to be identified ,
3. to reduce the necessity for constant learning,
4. to provide direction,
5. to order and relate classes of objects.

Such a list provides powerful justification for devising courses at all levels that are concept-based.

Problem solving

Ausubel and Robinson (1969) (in a text that should be essential reading for all teachers!) confess that problem solving and creativity are not even understood and are difficult to produce in the classroom.

Gagné's (1965) definition of problem solving is rather too simple ("Two or more previously acquired principles are somehow combined to produce a new capability"), too mechanical and ignores the internalising required to solve problems.

Ausubel and Robinson (1969) suggest that in problem-solving, the individual perceives a gap between his "givens" and his "goal". Into the gap he brings the following concepts and processes:

- relevant background information
- rules of inference
- strategies.

It is the course designer's task to ensure that the student possesses relevant background information, knows the ways in which that information can be manipulated and is familiar with the rules of inference for problem solving to be successful. One of the serious errors made by "discovery-learning" protagonists in recent years has been to ignore this.

Problem-solving need not be restricted to science and mathematics. Merrifield et al. (1962) envisaged the total problem-solving process as having five phases:

- preparation
- analysis
- production
- verification
- reapplication.

Such a scheme lends itself to a wide variety of subjects.

Hierarchical theories of development

Two of the best known hierarchical theories of development are those by Piaget and Gagné. Jean Piaget is essentially a philosophical psychologist who trained in Zoology. His work in Switzerland has been concerned with logical operations. "He observes the child's surroundings and his behaviour, formulates a hypothesis concerning the structure and underlies and includes them both, and then tests that hypothesis by altering the surroundings slightly." (Phillips, 1969) Robert Gagné's American studies started in 1962. "He attempted to teach seven children how to find formulas for sums of terms in number series. Gagné suggested that this skill could not be acquired unless the learners possessed certain prerequisite skills, which were identified by asking 'What would the individual have to be able to do in order that he can attain successful performance on this task, provided he is given only instructions?' " (White, 1975).

Hierarchical theories in general, and the work of Piaget and Gagné in particular, have recently been criticised by Phillips and Kelly (1975) who claim that the scientific status of the theories is obscure and that "it is not clear what type of evidence would count as confirmation or refutation of such a theory, or indeed whether empirical research is relevant at all".

Piaget

A very simple summary of Piaget's theory is shown in Figure 1.

Approximate Age

0-2 years	Sensorimotor period (e.g. walking, eating, crying)
2-7 years	Preoperational subperiod (e.g. acquisition of language)
7-11 years	Concrete operations (ability to reason in concrete situations)
11 + years	Formal operations

Figure 1 A summary of Piaget's theory.

Not all children reach the same stage at the same time and so the ages are very approximate.

A good example of the use of the theory is to be found in the Schools Council 5-13 Project (1972) which organises its course aims into three stages. The aims concerned with "communicating" are shown in Figure 2.

Stage	Communicating Aims
Stage 1	Ability to use new words appropriately
Transition from intuition to concrete operations (infants generally)	Ability to record events in their sequences Ability to discuss and record impressions of living and non-living things in the environment.

Stage (contd.)	Communicating Aims (contd.)
Concrete operations	Ability to tabulate information and use tables
Early stage	Use of representational symbols for recording information on charts.
Stage 2	Use of non-representational symbols in plans, charts, etc.
Concrete operations	Interpretation of observations in terms of trends and rates of change
Later stage	Use of histograms and other simple graphical forms for communicating data
Stage 3	Selection of most appropriate graphical form to suit information
Transition to Stage of Abstract thinking	Use of 3-dimensional models or graphs for recording results Deduction of information from graphs: from gradient, area, intercept

Figure 2 Schools Council 5-13 Project communicating aims

Similar lists of aims for other subject areas can be devised so that a teaching progression based on Piaget's theory is produced.

It has often been assumed that all tertiary level students have reached the Stage of Abstract Thinking. Beard (1969) casts doubt on this. If true, this has particular implications for course planners in higher education.

Gagné

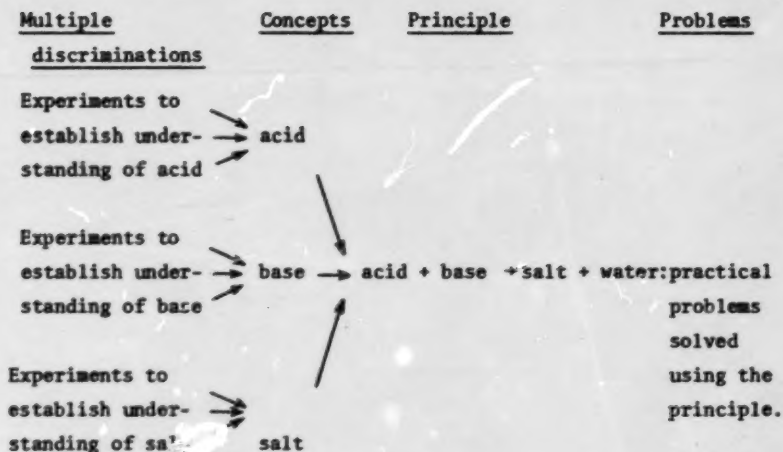
Gagné (1967) suggests that there are eight types of learning:

1. Signal learning
2. Stimulus-response learning
3. Chaining
4. Verbal association
5. Multiple-discrimination learning
6. Concept learning
7. Principle learning
8. Problem solving

These types are both hierarchical and cumulative, i.e. level 8 is more complex than level 7 which is more complex than level 6 (and so on) and level 8 incorporates all of the other levels.

The best example of Gagné's theory in curriculum design is that of the Schools Council Integrated Science Project, Hall (1973).

A simple example taken from the scheme is shown below.



This hierarchy lends itself particularly well to the development of science and mathematics courses and to the teaching of linguistics. Gagné's own application of his ideas is to be found in Gagné and Briggs (1974).

Programmed learning

Davies (1971) has a useful summary of programmed learning in a book which adopts the conventional "hardware" and "software" approach.

Teaching is both a science and an art. Within the scientific area, educational technology may have a small part to play; within that part is programmed learning. The learning theories upon which programmed learning is based are old ones: Thorndike's (1913) Laws and Skinner's (1938) behaviour of organisms. Thorndike's Laws are particularly interesting (the interpretations are mine):

1. Law of exercise (Practice makes perfect.)
2. Law of use (If you do something once, it is likely that you will be able to do it again.)

3. Law of disuse (Without practice you will forget.)
4. Law of effect (If you enjoy doing something, there is a better chance of remembering than if you don't enjoy doing it.)
5. Law of readiness (Satisfaction comes from a task when people are ready to undertake that task.)

Skinner took Thorndike's Law of effect, applied it to animals (including people) and introduced the term "teaching machine". History may well reveal that Skinner's application of Thorndike's Law in this way did more harm than good to the programmed learning movement. Certainly, some of the early linear programmes did little to advance educational technology, as the following (tongue-in-cheek) example shows.

1. Any object which gives off light because it is hot is called an INCANDESCENT LIGHT SOURCE. Thus a candle flame and the sun are alike in that they are both i _____ l _____ s _____.
2. When a blacksmith heats a bar of iron until it glows and emits light, the iron bar has become an i _____ l _____ s _____.
3. An object which gives off light when it is hot is called an _____.
4. Dichlorogluorescein gives off light. Dichlorogluorescein is an _____.
5. an _____.

But we would not do this kind of thing today, would we? Or wouldn't we?

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DESIGNING

VISUAL MESSAGES

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Ours is a visual age. According to a study by Powell (1967), investigating the viewing habits of Australian children, thirteen year olds spend $3\frac{1}{2}$ hours per day watching television. This means that roughly 25 hours per week are spent watching television, or 1300 hours per year - compared with the 1200 hours per year spent in school! Also, children regularly view films as part of their entertainment and as part of their formal education. An increasing number of children see the world directly as families travel more widely. There is growing evidence to suggest that the ability to think visually plays an important part in creative thinking (Hutton & Lescossier, 1976). Several important scientific discoveries have been the result of using visual imagery. Kekule's discovery of the shape of the benzene molecule while visualizing snakes before a fire is one famous example.

This suggests that the designer of educational messages - the classroom teacher, the audiovisual specialist, the commercial television producer - should be aware of the factors that influence visual thinking. McKim (1972) suggests that visual thinking has three components: seeing, imagining (imagery), and drawing. These three operations of visual thinking overlap so that seeing provides impetus for drawing, while drawing stimulates seeing and imagining. Visual thinking is experienced at its fullest when seeing, imagining and drawing interact. Designing visual messages can be seen as an extension of visual thinking, depending, at least in part, on what we see (perception) and what we picture in our heads (imagery).

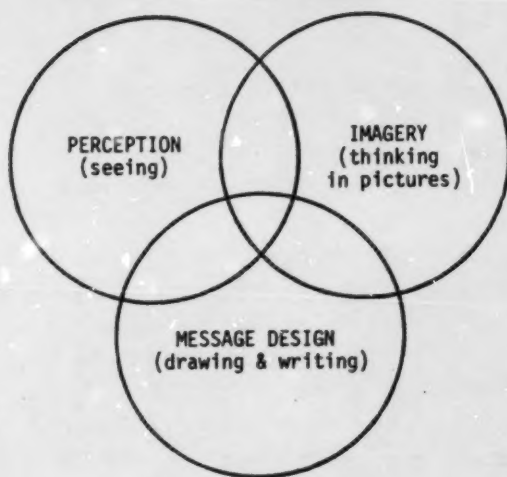


Figure 1 Visual Message Design

In the following sections we will discuss the implications of perception and imagery for the design of visual messages.

Perception

For years, teachers of photography have explained the camera by referring to the human eye, while physiology teachers have explained the eye by comparing it to a camera. This eye-camera analogy may have been helpful, but, as Fleming (1969) points out, it is rather simplistic and fails to account for many of the unique ways in which vision gathers information. When we look at a scene, face, strange room or picture, the eyes are continually fixating for a moment on one point, then darting to another point, fixating briefly again, and so on. And the only part of the retina which transmits sufficient information to the brain to form a critically sharp, colour representation of the outside world is a small depressed

section known as the fovea centralis. So the brain is presented with the enormous task of piecing together, and deriving meaning from, an apparently haphazard barrage of visual fragments thrown to it by those darting, scanning, searching eyes out front. Becoming aware of a stimulus presented to the eyes and attaching meaning to it is what seeing or visual perception is all about - and the brain is clearly as important in these processes as the eye. Perhaps the eye is best considered as an extension of the brain.

Some aspects of visual perception can be identified and measured as optical and physiological facts. For example, viewing distance, brightness, contrast and colour of the visual stimulus will all affect the image that forms on the retina. The acuity of the eye coupled with the pattern of eye movements employed in search will in turn influence the nature of information sent to the brain. However, other aspects of visual perception are psychological, rather than purely physical, drawing on a variety of brain activities such as retrieval of memories, examination of concepts and values, problem-solving and decision-making. Differences in the cultural background and experience of individuals will obviously influence the meaning observers derive from a picture. Intelligence, attitude and expectancy will also contribute to the way the brain interprets the visual stimulus (see figure 2). One thing is certain - for almost any human observer, there will be an incessant search for meaning. Even if the designer of the visual stimulus did not intend a particular meaning in his work, the observer will hunt one out - just as many of us find ourselves projecting meaning into cloud patterns in the sky, Rorschach ink-blots or an art-gallery of abstract paintings.

VISUAL STIMULUS



PHYSICAL FACTORS

(distance, brightness, contrast, colour)



PHYSIOLOGICAL FACTORS

(acuity, eye movements)



CULTURAL DIFFERENCES

(nationality, customs, environment)



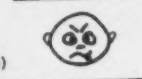
EXPERIENCE

(age, education, vocation)



ABILITIES

(aptitude, skills, intelligence)



ATTITUDE

(interest, expectancy, motivation)

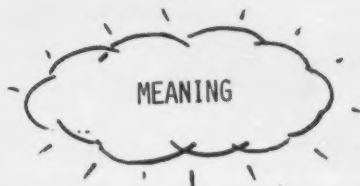


Figure 2 Factors influencing visual perception

For the message designer, there is a clear warning from our current understanding of visual perception: "Organize the visual material you present to the learner, or he will impose some organization on it himself." Of course, this may not always be bad, but it does point to a responsibility to decrease ambiguity and make clear the structure of learning materials, when working toward stated objectives.

According to the Laws of Gestalt Psychology (Fleming, 1971; Zakkia, 1975) man groups similar things and separates different things. These similarities and differences which man hunts for may be separated by time or space. As message designers we can assist the learner in interpreting visual materials if we use such devices as lines, circles, boxes, and colour to provide unity and stress similarities. We can also use lines and arrows and changes in size and colour to provide the emphasis needed to distinguish between objects, ideas or concepts. All of these devices are attempts to translate the structure of the knowledge to be learned into the design of the visual materials which are to stimulate that learning.

Imagery

Imagery may be defined as "pictures in the head" (Hutton & Lescohier, 1974). Horowitz (1967) and Holt (1964) point out that there are many different kinds of imagery - from dreams and hallucinations which achieve such vividness that the receiver cannot distinguish them from reality, to the less dramatic visualizations of daily thought. In some ways imagery is like an iceberg in that some kinds of mental picture are at the surface of consciousness and can be readily controlled, whereas other kinds are beneath the surface and are less controllable. The following "imagery iceberg" distinguishes three major types of image. At the top of the iceberg are images which are usually not vivid but which,

with practice, can be controlled and used in thinking (thought images). In the middle of the iceberg are memory images varying in vividness from photographic memory (eidetic imagery) to the common memory image aroused on hearing a familiar word. At the bottom are hallucinogenic images - extremely vivid mental pictures which are usually uncontrolled in content and presence.

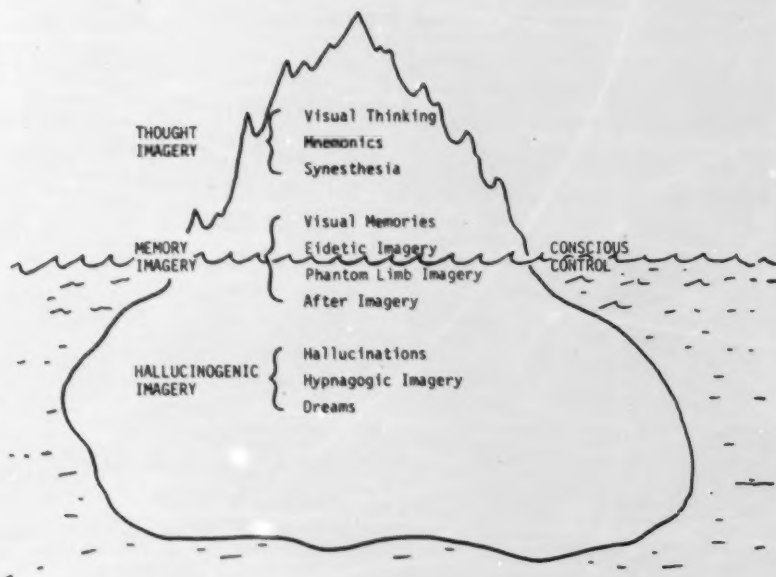


Figure 3 The "imagery iceberg"

Thought imagery involves the deliberate, controlled use of mental pictures as vehicles for thought alternative to language. One type of thought imagery is the mnemonic image - or the use of mental pictures to aid memory in learning. An impressive number of studies,

e.g. Kirkpatrick (1894), Schnorr & Atkinson (1969), Bower (1969), and Bulgelski, Kidd Segmen (1968), suggests that linking visual imagery with verbal material results in astonishing learning. Perhaps these results are not surprising in light of research (see Paivio, 1971) which indicates that visual imagery and language are alternative coding systems in memory. Work by Gazzaniga (1970), Sperry (1968), and others suggest that the left half of the brain is specialized for tasks involving language, while the right half is specialized for tasks involving the visual imagery. Taken together, these studies appear to indicate that linking visual imagery with verbal material fully utilizes our thought capacities.

Another form of thought imagery is synesthesia or multimodal thinking - where experiences in one sensory mode evoke images in another mode. McKim (1972) suggests that synesthesia can be cultivated by practising a multimodal approach to the perception of objects in the environment. For example, when given an apple, feel its weight; imagine biting into it; imagine the taste of it; the sound of eating it; and its smell. He suggests that learning is enhanced when the information stored in the brain about something is multimodal. Certainly this is consistent with the results of studies which show that memory for verbal information is increased when linked with visual memory aids.

A second category of imagery is that of memory images - visions of past experiences. Eidetic imagery is an extremely vivid type of memory image. It is so exceptionally clear and accurate that eidetikers can commit a geographic map to memory so that the imaged map can be visually scanned as if it were a real map. Because of its clarity, the eidetic image has been called "photographic memory". Jaensch (1930) found that approximately 40% of all children have eidetic imagery while only 7% of adults have it. Richardson (1969) suggests that the less than totally real memory image known

to most of us is what is left of an earlier "photographic memory". This ability tends to disappear in the normally developing Western child as he enters high school and a language dominated world. Murphy (1963) suggests that something of the photographic quality of eidetic imagery can be gained by such visual calisthenics as "flashing". Flashing is a method for developing memory imagery by comparing a visual image with the real object. The method works as follows. First, look at an object, then close your eyes to produce the clearest image of the object possible. Open your eyes and compare this image with reality. Repeat the process. An improvement in the clarity and accuracy of memory imagery should result.

The third type of imagery, hallucinogenic images, are vivid, uncontrollable mental pictures that appear real to the receiver. Dreams are defined as normal hallucinations occurring during sleep. For some people dreams are important to creative visual thinking. The physicist, Neils Bohr, conceived of his model of the atom in a dream. Kippner & Hughes (1965) refer to many creative dreamers who have used dream material in their writing, including Goethe, Blake, Voltaire, Dante, Shelley, Tolstoy and Coleridge. McKim (1972) suggests that creative dreaming can be fostered by directing dream thoughts as one might direct waking consciousness. Concentrating on a frustrating problem or reviewing work to be done just before going to sleep is one method for attracting productive dreaming.

A normal hallucination particularly fruitful for message design is the hypnogogic image experienced in the drowsy state before falling asleep. Hypnogogic images are characterized as sharp, flowing, dream-like fantasies of surprising novelty. About one-third of all adults and many children are reported to experience hypnogogic images. Hypnogogic imagery like dream imagery appears to be trainable. Exercises such as this are designed to foster hypnogogic

imagery: relax your body, especially the eyes, reduce all outside sensory stimulation, silence verbal thinking while attending to inner thoughts and feelings.

In conclusion, the study of visual imagery has important implications for the designer of instructional messages. Not only should he consider the ability of the learner to perceive meaning in the visual stimulus, but also he should consider the many alternative forms of mental pictures which the learner may use.

Message design

Message design is the planning of materials to be used in communicating information. A close look at communication suggests that we use 5 different types of messages. (1) We use words to describe something. (2) We use pictures as icons to show what something looks like. (3) In addition, Knowlton (1964) points out, we can use pictures as visual analogies to show the similarity between things. (4) And we can also use pictures logically to show the spatial relationship between things. (5) Finally, we can use pictures and words as signals to call attention to something. The relationship between these five types of messages can be represented:

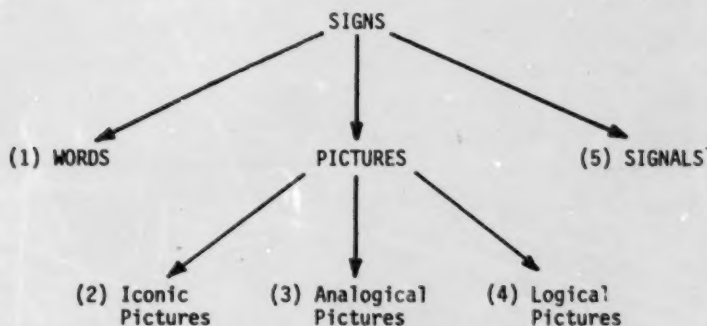


Figure 4 Five message types

Most communication involves the use of symbols. Symbols are pictures and words which represent concrete objects and abstractions such as ideas, concepts, and scientific principles, in the real world. Words are, for most adults, the most commonly used symbol. They symbolize experiences by labelling them. Hayakawa (1972) points out that labelling is an indispensable convenience for thought. Abstract words such as "wealth" allow thinking to embrace far larger meanings than do concrete words such as "cow".

Knowlton (1964) makes the point that pictures can symbolize the real world in one of three ways. Iconic pictures show what the real world looks like. The picture may have great detail, as in a photograph, or a cartoon with little detail, but the intent is the same - to show the real world. Analogical pictures describe something by showing something else - usually something more familiar to the message receiver. For example, a picture of a factory can be an analogical picture of the process of yeast fermentation. Logical pictures show the spatial arrangement between things in the real world by using spatial arrangements of symbols such as words, map symbols and the symbols of electronic circuitry. Organization charts, flow charts, Venn diagrams, and sociograms are examples of logical pictures. Words, iconic pictures, analogical pictures, and logical pictures symbolize the world in four different ways. A fifth type of message the signal simply points out things in the real world. Signals may be either verbal - "Look!" - or visual - the familiar picture of a skull and cross bones marking dangerous chemicals. The importance of the signal is suggested in the work of Bliss (see Breckon, 1975) who has developed a system of graphic signals. Examples are:

Hard



Easy



Good Material



Give special
attention



One implication for message design is that signals such as the Blissymbols, could be used much more frequently in educational materials to emphasize important parts of an instructional message.

The algorithm shown in figure 5 for designing visual messages is based on the points we have discussed: (1) that learners search for meaning in the messages they receive, (2) that there are many kinds of images important in thinking, and (3) that at least five different types of message are useful to the design of visual messages.

The first two steps concern the relationship between the content of what is to be taught and the learner. Writing behavioural objectives provides a basis for selecting specific content. Decide what responses are expected from the learner after he receives the message, such as writing an essay, showing appreciation of a painting, or making a well-cooked omelette. Consider characteristics of the learner, e.g. age, educational level, intelligence, sex, and familiarity with the topic. Then tailor the content of the message to try to bring about desired response. Types of messages should be considered appropriate to the content of the topic, the learner's characteristics, and the desired response to the message. An analysis of the topic, how to fry an egg, might look like this:

TOPIC:	How to fry an egg!
RESPONSE DESIRED: (Behavioural Objective)	Fry 2 out of 3 eggs so that the whites are set but the yolks are liquid.
LEARNER CHARACTERISTICS:	7 year old boys interested in cooking.
TYPES OF MESSAGES:	ANALOGICAL PICTURES: The introduction will show a series of pictures of a house being built to stress the step by step nature of frying an egg.

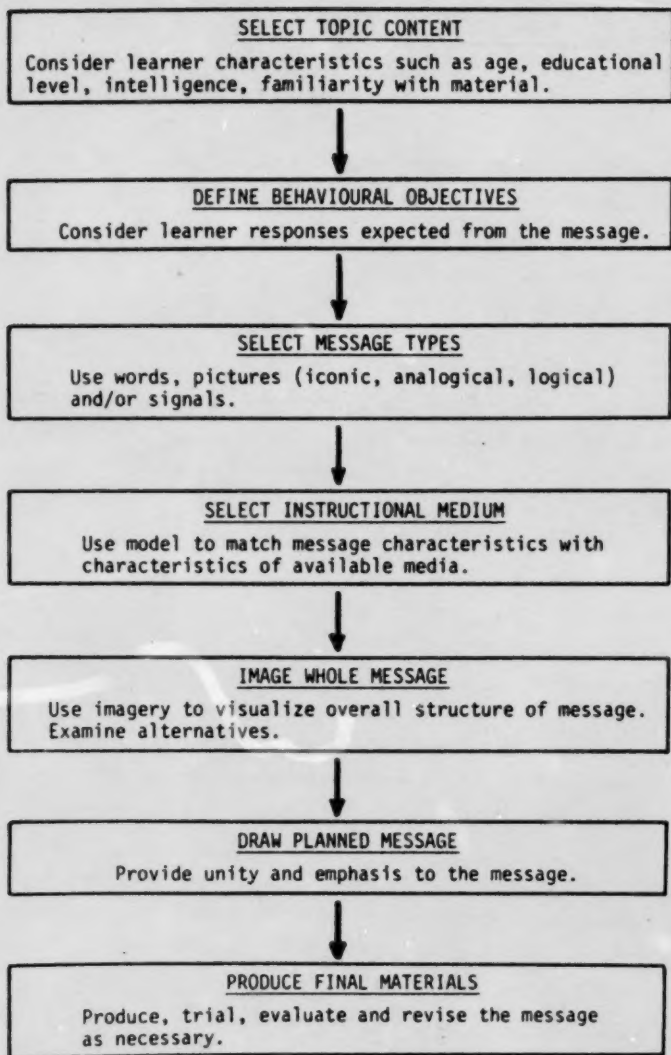


Figure 5 Message design algorithm

LOGICAL PICTURES: The steps in frying an egg will be laid out verbally in flow chart form.

ICONIC PICTURES: Photographs of the procedure will accompany each step in the flow chart.

SIGNALS: The following Blissymbols will be used where appropriate:

- | | |
|------------------|---|
| 1. Easy step |  |
| 2. Hard step |  |
| 3. Look at egg |  |
| 4. Listen to egg |  |

The fourth step is to select an instructional medium (television, film, books, etc.) which will best communicate the message. There are no rules for media selection which will guarantee a successful decision; however, several models for media selection provide some guidelines (Kemp, 1974; Briggs, 1970; Levie & Dickie, 1973).

The study of perception suggests that the next step is to imagine the message as a whole. Laws of perception point out that the receiver of a message first perceives the message as a whole. Then he perceives emphatic parts within the whole. Two guiding principles for message designers are suggested. Provide unity to the message, using the elements of line, shape, texture and colour to place together, or enclose messages that should be unified. On the other hand, use line, shape, texture, colour to emphasize parts of the message that should stand out, as figures stand out from the background. The use of imagery to see the message as a whole is very useful. Imagery is the mode of thought which lends itself to seeing things as a whole. For most of us, the details of an image are somewhat vague. Once the overall structure of the message is

imagined, the details can be filled in during the next stage of message design, drawing the planned message. The final stages of message design can be thought of as a cyclic process of producing the message, trialing the product with learners, evaluating the trial, and revising the message as necessary.

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EDUCATIONAL TECHNOLOGY:

A BIBLIOGRAPHY OF REFERENCE MATERIAL

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Introduction

This bibliography has been compiled to provide practising educational technologists, teachers and students with a brief list of helpful reference material. It is intended as a guide to where material of interest to educational technologists has been and is being published. All of the material listed is available in local libraries. Users are invited to contact the compiler if they experience difficulty in locating any item.

Organization

The reference material has been organized into five sections. Brief notes on each of the sections follows.

1. Directories

The four books listed enable users to locate a wide range of sources of hardware and software. The APLET Yearbook is particularly useful for its guide to programmed learning material. The Australian audio-visual reference book is the best source book of its kind published in Australia. Both of these publications are issued annually and users should check for possible later editions than those listed here.

2. Indexes

Education indexes contain classified lists of publications on topics in education.

Because the indexes list materials from a wide range of books, monographs, journals and newspapers, their coverage is very comprehensive and therefore extends well beyond the confines of the broadest interpretation of the concept of educational technology.

The Social Sciences Citation Index is a recent library tool of particular help to those who are interested in tracing the utilization of particular authors' publications. For example, if 'Piaget' is consulted in the Index, a list of references will be given in which the works of Piaget have been cited. (Very useful for essay and thesis writers!)

3. Bibliographies

The most comprehensive bibliography listed is Stagg and Erauts' (1975). Most of the others are specific bibliographies located in the major journals. Of course, some of the most valuable bibliographical aids are reference lists that appear at the end of many journal articles. In this regard, the articles listed in section 5 (Reviews) ought to be consulted by those who wish to pursue particular topics (such as objectives) in greater depth.

4. Journals and magazines

A complete list of journals of interest to the educational technologist would fill this whole publication! On the other hand, the number of journals devoted specifically to educational technology is really quite small. The journals listed in this section represent a compromise between these extremes. The list includes research-based publications (such as AV Communication Review and Instructional Science) and semi-popular magazines (Educational Technology, Visual Education, etc.).

5. Reviews

Many of the leading journals carry occasional articles that review the literature on specific topics or problems. One purpose of these articles is to ascertain whether the research literature, as a whole, is able to offer practical help to educationalists. Some journals, such as the Review of Educational Research are devoted specifically to these types of articles and should be consulted regularly to provide up-to-date information on research findings in education. The Second handbook of research on teaching is an important source of material on teaching and learning at all levels of education and complements the more specific journal articles (although the Handbook's content is becoming increasingly dated).

THE BIBLIOGRAPHY

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A directory of materials available for primary and secondary school students and for teachers.

Howe, A. and Romiszowski, A.J. (eds.) International yearbook of educational and instructional technology 1976/77. Kogan Page for the Association for Programmed Learning and Educational Technology.

A wide range of information is published in this book including

bibliographies, notes on methods, a comprehensive list of programmed materials available in the U.K. and a guide to hardware.

Nicholson, J. (ed.) (1975) Australian audio-visual reference book 1975. Thorpe.

The contents include information on film acquisition, material available from Departments of Education and detailed lists of software and hardware.

2. INDEXES

Australian Education Index. Australian Council for Educational Research. Published bi-monthly and cumulated in an annual volume. (First published in 1958.)

British Education Index. British Library Bibliographic Services Division. Published quarterly and cumulated in an annual volume.

Education Index. H.W. Wilson.

Published monthly and cumulated in an annual volume.

Resources in Education, Educational Resources Information Centre (ERIC). "A monthly abstract journal announcing recent report literature related to the field of education."

Social Sciences Citation Index. Institute for Scientific Information. "An international multi-disciplinary index to the literature of the social, behavioural and related sciences."

Research into higher education abstracts, Society for Research into Higher Education (SWHE).

A quarterly publication mainly describing research publications. One section of each issue is devoted to educational technology.

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AV Communication Review. Published quarterly by the Association for Education Communications and Technology, 1201 Sixteenth Street, N.W. Washington D.C. 20036. Annual subscription US\$21.50.

British Journal of Educational Technology. Sponsored by the Council for Educational Technology, 10 Queen Anne Street, London. Annual subscription £6.50.

Educational Media International. Published quarterly by the International Council for Educational Media, 33 Queen Anne Street, London. Annual subscription £5.

Educational Technology. Published monthly by Educational Technology Publications Inc., 140 Sylvan Avenue, Englewood Cliffs, New Jersey. Annual subscription \$29.00.

Instructional Science. Published quarterly by Elsevier Scientific Publishing Company, P.O. Box 211, Amsterdam, The Netherlands. Annual subscription US\$22.00

Programmed Learning and Educational Technology. Journal of the Association for Programmed Learning and Educational Technology, 33 Queen Anne Street, London. Published four times a year. Annual subscription £10.

Journal of the Society for Mass Media and Resource Technology. Published quarterly by SMMART (S.A.), P.O. Box 44, Ingle Farm, S.A. 5098.

Viewpoints. Bulletin of the School of Education, Indiana University, Bloomington, Indiana, USA. Published bi-monthly. Annual subscription US\$8.00.

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NOTES

The Australian Society of Educational Technology Yearbook is available to all members of the Society. Additional copies may be obtained for \$1.50 each (post paid) from

The Editor,
ASET Yearbook,
Advisory Centre for University Education,
The University of Adelaide,
Adelaide. S.A. 5000.

Bulk order rates will be supplied on application.

The Editor invites for consideration articles or research papers on aspects of educational technology likely to be of interest to readers. Manuscripts should conform to the style used in this edition of the Yearbook.

PLANNING AND
EVALUATING THE USE
OF AUDIO-VISUAL EQUIPMENT
IN SCHOOLS

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In order that new schools may be adequately equipped with a balanced array of audio-visual equipment, administrators are frequently called upon to devise some form of "Equipment Issue Scale". In other situations principals of established schools may wish to expand their stock of equipment to support particular projects. These difficulties are complicated by the wish of administrators and educationalists to evaluate the use of existing or proposed equipment in terms of the equipment actually needed to meet a problem.

Equipment issued to a school could either influence the style of teaching or, conversely, the style of teaching and the likes or dislikes of the teaching staff could influence the useage of particular equipment. In the former case (of equipment stock determining teaching style), a school equipped with many listening posts and carrels with individual equipment would tend to provide individualised instruction and small group learning. The alternative in this case would clearly be to conduct conventional classes with the equipment (which is not suitable for large group use) lying idle in a cupboard! In an example of teaching style influencing equipment useage, a teacher very interested in the use of movie film could expand the use of Super 8 equipment (both for creative film making and as an instructional aid) in many curriculum areas. A consequent problem might be the forced useage of a medium which may not be suited to particular requirements in teaching and learning.

There is a clear need for a technique to allow administrators, principals and teachers to examine the audio-visual equipment that the school possesses in terms of some objective parameters. These parameters would not be treated as absolute definitive norms, but would be useful as empirical levels against which the equipment in a particular school could be measured in terms of types and quantity required. It was to this end that we developed the following technique.

Each school is allotted two index ratios, one being proportional to the number of teachers in the school (Figure A), the other being proportional to the number of students (Figure B). To supplement these ratios, we developed a factor for each type of equipment (Table A). By multiplying each equipment factor by the school's teacher index ratio or student index ratio, we obtain a base figure for each type of equipment. (The teacher index ratio is used when dealing with teacher oriented items such as video tape recorders, and the student index ratio for individualised student-oriented items such as headphones). The base figure for each item indicates the number of pieces of that particular type of equipment which could be regarded as a datum level for that school - a datum level against which other schools' useage and issues of equipment can be compared.

For example, if the factor for overhead projectors is 1.2 and a school with 24 teachers has a school/teacher index ratio of 6, then one would expect the school to have 7 projectors (approximately 6×1.2).

The two Figures, A and B, appear of similar shape. If however, they were plotted on axis of equal scale, Figure B would appear much more linear. This gives an indication as to the basic philosophy from which the values of the index ratios were achieved.

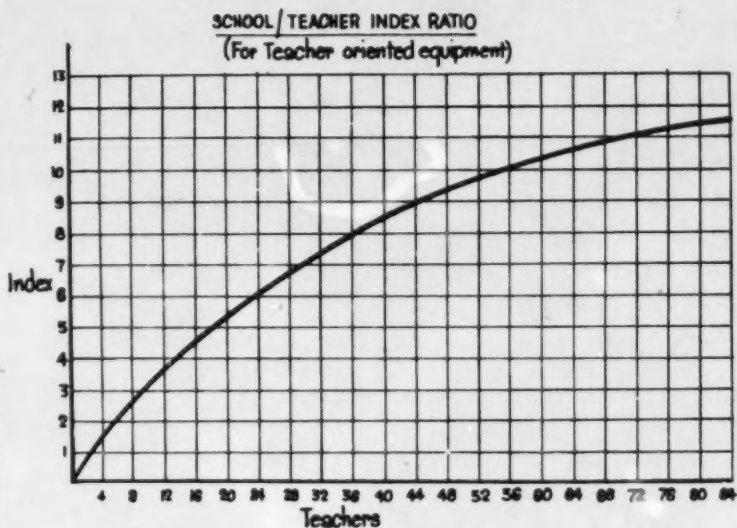


Figure A

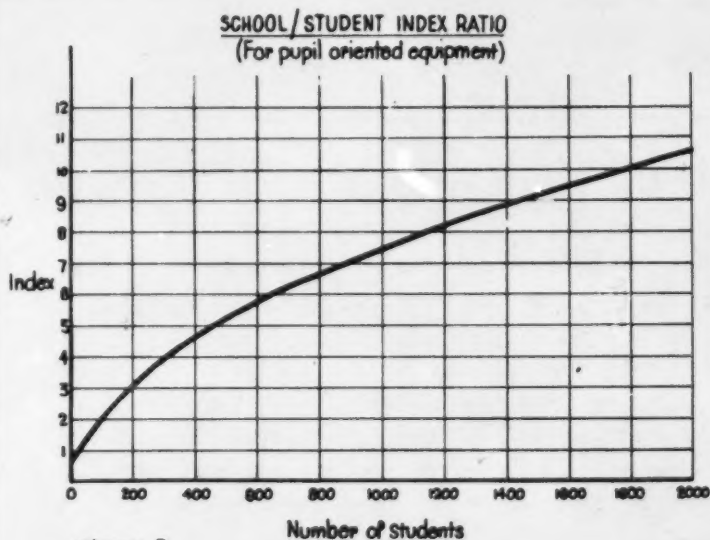


Figure B

TABLE A: EQUIPMENT FACTORS

<u>Teacher Oriented Equipment</u>		<u>Student Oriented Equipment</u>	
	Factors		Factors
*Radio	.40	Projectors 35 mm (small)	4
Movie projector 16mm		Listening posts	1
(with stand)	.40	Cassette recorder	1.5
Movie projector 8mm	.25	Cassette player	4
Screens (portable)	.45	Slide viewer	4
Video tape recorder	.40	Language master (card reader)	1
TV Monitor Rec/Monitor	.45		
Overhead projector	1.2	Daylight screens (folding)	1.5
35mm projector (auto)	.45	Headsets	6
35mm projector F.S./slide	.25		
Cassette recorder	.70		
Record player stereo	.25		
Epidiascope	.25	*Note: This does not take into account the built-in radio which all schools would have fitted to their public address distribution system.	
Reel-reel tape recorder	-		
Video camera	.25		
Portable public address system	-		

In fact, the fundamental rationale of the two Figures was of a student teacher ratio of 1:24, this being the average overall figure in South Australia. Therefore, if on Figure B the number of students is divided by 24, then one achieves Figure A. For simplicity two graphs are used and reproduced separately.

The overall curve appearance of the graphs is an obvious feature and is a clear requirement of the situation since a decreasing rate is demanded as numbers of students and teachers increases. However, the slope at which the curves leave the origins must be at a disproportionate rate of increase of equipment in view of the extremes

of these requirements, (that is one cannot have a fraction of a piece of equipment!)

The factors themselves in Table A were really achieved on an empirical basis using the cross index ratios to produce realistic figures in the extreme.

It should be emphasised that the figures are not aimed at producing a datum level against which existing and future stocks of equipment and useage can be related and, more particularly, against which the needs and uses of other schools can be compared.

Equipment and policy

In the case studies included with this paper some specific school situations in South Australia have been examined, based on their equipment returns at the end of 1975. These case studies illustrate typical situations which differ considerably. The relationship between actual equipment held and the equipment base graphs that are illustrated should be a means for administrators and principals to gauge equipment useages and needs if they wish the style of education and teaching to proceed in the manner described for that particular area. It can be seen that a particular style or manner of education influences, in specific ways, the amount of equipment held.

One consequent policy would be to equip each school to the base standard according to the school's teacher and student index ratios. This would provide an across-the-board selection of audio-visual equipment for each school to be further developed or expanded in any particular direction desired by the school's administration. However, it would be equally feasible, in consultation with the administration, to decide in advance on the intended teaching styles of the school and to influence the base issue accordingly.

A policy could be made regarding overall issues of equipment such as overhead projectors. If the policy was to equip to a base standard and then to gradually expand the degree of application of such equipment a gradual increase in the equipment factor could be progressively made. This increase would highlight the expanded demands, and shortfalls could be continuously met until such time as all schools were equipped to the new indexed levels.

The major value of this investigation lies in a close analysis of the case studies which follow. For it is in these situations, where known styles of leadership, educational administration and teaching practice exist, that the related equipment stocks which support such situations can be closely compared and related to others.

In order to compare the various situations in schools of different sizes, the case study graphs plot the expected factor, together with the actual equipment stock held, having first divided the latter by the index ratio. This in effect compares the actual factor held with the factor suggested and provides a direct comparison for all schools. The schools compared are anonymously recorded, but are actual situations, broadly described at the heading to each case study.

The conclusions drawn are entirely our own and relate to several known local socio-economic parameters. It may well prove necessary in other situations to modify the findings or arguments according to somewhat different socio-economic parameters.

SOME GENERAL NOTES TO ACCOMPANY THE CASE STUDIES

T.V. and Radio

Adelaide has 8 radio stations -

3 Australian Broadcasting Commission (ABC) (2A.M., 1 stereo F.M.)
4 commercial and 1 listener-funded (operated by the University)
which has "air time" for access programmes.

There are also 4 T.V. stations -

1 ABC, 3 commercial.

Formal educational broadcasts are transmitted only via the ABC network.

Schools

Year 1-2	junior primary)	sometimes combined)	sometimes combined
	) under title	) in country as	
Years 3-7	primary	) "primary"	) "area school"
Years 8-12	secondary	)	

CONCLUSION

The rationale by which the equipment index graphs relate to the base graph is a strong one and it must be one of the few methods by which equipment issues and scales can be visually and graphically related, rather than by consulting lists of numbers of items of equipment as detailed in such references at Standards for school media programmes (1969).

Our proposed system allows many comparisons and adjustments to be made without leading to equipment issues being made in a manner unrelated to the present and future teaching needs of the school.

REFERENCE

American Library Association and National Education Association
(1969) Standards for school media programmes. Chicago.

CASE STUDY A: A country town's Junior Primary School

District: Socio-economically disadvantaged. High percentage of immigrants (mainly from Italy and Greece) and high number of Australian-born children of immigrants. Many bi-lingual children. Main industry : fruit growing. District relies on sales thereof. Income not consistent throughout year. Two radio stations (1 ABC, 1 commercial). Commercial radio station has two hours weekly in the Greek language. Sport follows ethnic lines (soccer has teams sponsored by migrant groups). No Italian language broadcast. (Station willing but has not been approached.)

Deficiencies Below Norm

Carrel projector, listening posts, cassette recorders & players, slide viewers, language masters, daylight screens, headphones (marginally below).	Radio, 16mm & 8mm motion picture proj., VTR, T.V. receivers, OHP, 35mm projectors (auto), cassette recorders, epidiastope, video camera.
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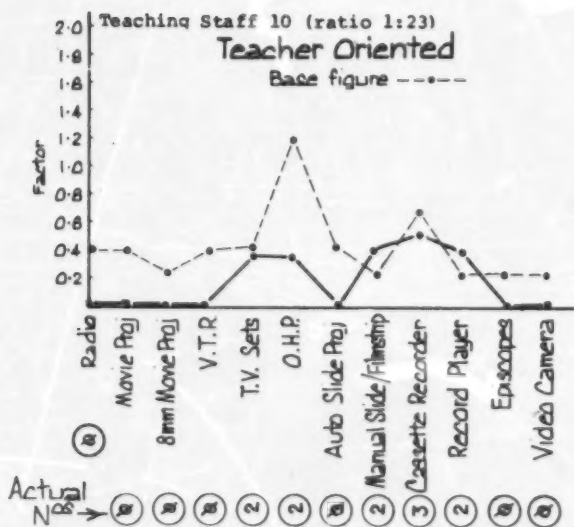
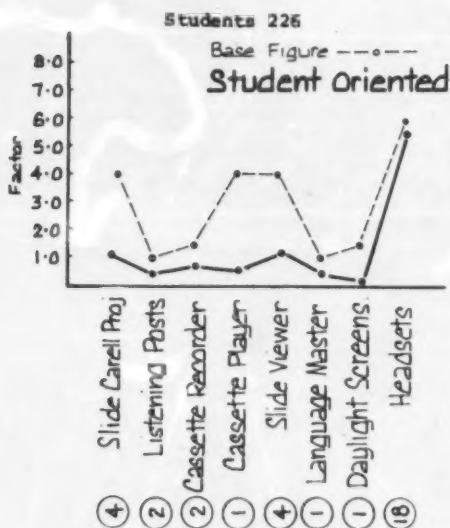
Excesses Above Norm

Nil.	35mm projector, stereo record players.
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Comments

1. Apparent little use of local ABC 3rd network radio station.
2. Low number of overhead projectors.
3. Adequate number of headphones: limited number listening posts & ancilliary equipment for student use.
4. Small number of projectors show low demand for slides or few in resource centre.
5. Material used by large number of classrooms - sharing.
6. Possible ineffective use of TV "off-air" broadcasts over ABC.
7. Surprising low low of language masters (1) considering proportion of bilingual children and of children who speak English only at school.

CASE STUDY A



CASE STUDY B: New metropolitan secondary school (open plan)

District: Outer metropolitan residential; only industries are shops and household service industries (TV repair, lawn cutting). Higher than average number of British migrants. 1 hotel, 1 licensed store, 1 licensed club, several churches, general practitioners. Teenage vandalism higher than average. Excellent bus service.

Deficiencies Below Norm

35mm projectors (marginal),	16mm projectors, VTR (marginal)
listening posts, slide viewers	video camera (marginal).
(marginal), <u>no</u> daylight screens	
or language masters.	

Excesses Above Norm

Cassette recorders, above	8mm projectors, TV sets (almost
cassette players, well above	double). OHP (well above), 35mm
headphones.	manual projectors, well above
	in cassette recorders, normal
	supply of stereo record players,
	well above in episcopes.

Comments

1. Interesting to note no daylight screens with high number of projectors.
2. Neither medium given preference.
3. Greater than normal requirement for 8mm equipment - would possibly indicate a teacher with an interest in this field.
4. Plentiful supply of equipment for student use.

CASE STUDY B

